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Performance Improvement Modeling
(Case Study : Micro and Small Enterprise)

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Abstract

The objective of this study is to model performance improvement of Micro and Small Enterprise (MSE) which produce snack. Analysis units are MSE located in Lampung Province of Indonesia. On this research, performance improvement model was built by 3 sub models, i.e. (1) customer needs and technical responses identification, (2) customer needs importance, correlation among technical characteristics, and correlation between customer need's importance with technical characteristics, (3) defining priority and recommend on performance improvement. Ordered Weighted Averaging (OWA) Operators is used to identify technical responses, relationship between each element of their technical response and each customer need. Quality Function Deployment (QFD) was used to improve MSE's performance priority and recommendation. To determine the technical correlation, relationship between customer needs and technical responses, and the absolute importance value, we used expert interview method and OWA Operators technique. Result shows that the most important to be improved is on creating new product.

Key Words : improvement, micro and small enterprises, strategic management system, customer needs, technical responses, performance improvement, ordered weighted averaging, quality function deployment, absolute importance, expert interview method.

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I. Introduction

On the development of MSE as the activator of economics' region, it is stated that the scope of commodities priority are (1) snack industry, (2) silk industry, (3) tanning industry, (4) oil palm industry, (5) fertilizer industry (nature and organic), (6) salt industry, (7) roof industry, (8) blacksmith industry, (9) boat industry < 100 GT, (10) the fishermen's motorization industry, (11) traditional of farming tool industry, (12) traditional weaving industry, (13) jewelry industry, and (14) plaiting industry.

Lampung is one of the provinces which have good potential in developing MSE, mostly in snack industry with the orientation of regional and export market (Industry and Trading Department, 1985). It is because Lampung has the potential supply of raw materials and supporting the industry's climate that exist for the performance of economic of democracy. One of the snack industries that has good prospect is banana crispy chips. Banana crispy chips industries in Lampung are spread out in region of Tanggamus, Lampung Selatan, Tulang Bawang and Lampung Tengah (Cooperation of Industry and Trading Department, 2004). It is predicted that the number of this industry will increase continually because banana is one of the main commodity of Lampung.

However, improving the competitive power of MSE which produce banana crispy chips depends on performance of MSE itself. Good performance can be managed efficiently and effectively if it is supported by optimal improvement of performance process. Performance improvement technique that is capable in mapping the customer as main indicator is needed to explore customer expectation performance. This is done in order to bring company closer to customer, and drive all people inside company to be involved in satisfying customers. Fully redesign process was needed to facilitate management to arrange elements in filtering, defining, and deploying customer voices on any level. In that case, management will be able to evaluate potential responses in order to represent universality of customer needs. Performance improvement tool that is used must be able to map limited resources and company condition as a basic of continuous and directed priority improvement.

Many researches have been done in modeling performance of an industry, as well as of Small and Medium Enterprises (SME). To name a few of them on SME are stochastic theories (Evans, 1987 a; 1987b; Hall, 1987; Kumar, 1985; Wagner 1992; Sutton, 1997; Beccchetti and Trovato, 2002; Weiss, 1998; Almus and Nerlimger, 2000; Segarra and Callejon, 2002), learning model (Jovanovic, 1982; Hopenhayn, 1992; Cabral, 1993), hazard model (Allison,

1984; McPherson, 1995; Caves, 1998), and financial failure prediction model (Keasey and Watson, 1986a; Keasey et al., 1990; Jain and Nag, 1997; Cadden, 1991; Chung and Tam, 1993; Liang et al., 1993). But so far, performance modeling from the point of view of strategic management system is not yet explored widely. One of literature which is talk about this is Hudson, Smart, and Bourne (2001). More ever, performance modeling of Micro and Small Enterprises (MSE) is rarely found on the literature.

Point out the role of snack industries, particularly banana crispy chips as activator of economics' region in Lampung Province, and the lack of literature in performance modeling of MSE, this research is intended to develop MSE's performance improvement model based on strategic management system. Balanced score card and quality function deployment are deployed to build the model.

II. Theoretical Background

Performance's Improvement Process

The strategy is needed by the industry in order to be able to achieve the result based on the vision, mission, goal and target of the company. The company's ability to place its position in the environment by considering and evaluating its condition from environmental factors which affects each other will hardly determine the success of the company. With strategic management, company can translate its strategy into a specific measurement process so have better capability to run the strategy with minimum risk. The measurement output then used as a feed back that can give more information about company's achievement on all it's activities in the company's value chain and can be the base of improvement strategy, that's called company's performance improvement.

Strategy on this case is used to justify planning and controlling activities (Yuwono, Sukarno, and Ichsan, 2004). On the other hand, according to Kaplan and Norton (1996), strategy management is needed in order to minimize risk in decision making process. Using strategic management system, a company is capable to operate its strategy into particular measurement system, so that the company has better capability to run the strategy with minimum risk. Measurement in the next phase can be used as feedback for suitable activities on company's value chain. According to (Younker, 1993), effective performance planning includes 3 main processes, i.e. pre performance measurement, performance improvement planning, and performance measurement post improvement.

According to Guralnik and David (1996) performance is achievement which is often used to show the ability or "the show" which is commonly used to show up the performance or it also means "doing the task that shows someone's action in working. On the other hand, it is defined that performance is the record of the result which is gained from the function of certain work or certain activities in the certain period of time.

Performance commonly used to evaluate the strategy. There are some obstacles in implementing the strategy that can be overcame by implementing the components of management strategy (Kaplan and Norton, 1996). In the perspective of management strategy, environment is the important and contextual factor which has the effect to the performance of the company (Child, 1997). The concept of modern management shows that the industry which is conducting an economic activity does not stand independently, but it is in the business environment which is affected each other. Generally, the company is in the centre of business environment that consists of government, people, customers, distributors, employees and the same industry which also being the competitor.

However the efforts toward performance improvement can be done not only by deploying internal environment, but also with external environment of the company, so that in determining performance indicators, company scale becomes important to be considered. Based on scale, a company can be differentiated into three categories, i.e. Micro and Small Enterprises (MSE), medium, and big companies. Among these 3 company scales, MSE dominates Indonesian economic structure. Main problem faced by MSE is low productivity. Based on existing price in 2005, MSE labor productivity is 14.6 millions Indonesian Rupiah (IDR), medium company 67.8 millions IDR, and big scale company is 482.5 millions (Central Bureau of Statistics, 2007).

Researches on design development of performance improvement of MSE which produce banana crispy chips focus on two different main interests. Most of researches still focus on MSE performances as single interest and the process of banana crispy chip itself (Siswoputranto, 1974; Hofsetz and Lopez, 2005). For instance, a researcher investigated the influence by adding some essences on banana crispy chip taste such as citrate acid, meta bisulphate natrium, cake soda, backing powder, and bicarbonate ammonium. He also concentrated in searching the best banana variety to be used as raw material of banana crispy chip (Siswoputranto, 1974). Process technology to produce banana crispy chip by investigating the influence of temperature and time have been studied by Siswoputranto (1974).

In addition, research on performance measurement commonly uses single measurement technique, whether it is based on performance index or balance score card. This lead to the urge to integrate techniques which are used to evaluate MSE performances completely by considering all factors whether they are external or internal factors. One could be the possibility to integrate balance score card and Quality Function Deployment (QFD). These two techniques have been considered in performance measurement and evaluation in education sector (Lee et al., 2000), financial sector (Aryo et al., 2003), and in tire industry (Marimin and Suryaningsih, 2002).

Ordered Weighted Averaging (OWA) Operators

In the first stage on OWA operators, individual experts are asked to provide an evaluation of the alternatives. This evaluation consists of a rating for each alternative on each criteria. Decision maker provides an aggregation function which we shall denote as Q. This function can be seen as a generalization of the idea of how many expert feels need to agree on a project for it to be acceptable. In particular, for each number i, where i runs from 1 to r, the decision maker must provide a value Q(i) indicating how satisfied them would be in selecting a proposal with which i of the expert were satisfied. The value for Q(i) should be drawn from the scale S= (S_1, S_2,…..S_n).

The function Q should have certain characteristics to make it rational:

1. As more expert agree, the decision maker's satisfaction or confidence should increase: $Q(i) \geq Q(j)$; $i > j$.
2. If all the expert are satisfied, then the satisfaction should be the highest possible: Q(r) = perfect
3. If no expert are satisfied the satisfaction to Q should be lowest: Q(o) = none

In the following we shall suggest a manifestation of Q that can be said to emulate the usual arithmetic averaging function. Manetsch and Park (1977) provide a formal justification of this relationship. In order to define this function, introduced the operation *Int (*a*)* as returning the integer value that is closest to the number a. In the following, let q be the number of points on the scale (the cardinality of S) and r be the number of expert participating. This function which emulates the average is denoted as Q_A and is defined for all i = 0, 1, ..., r as $Q_{a(k)} = S_{b(k)}$ where b(k) = Int [1 + (k * (q-1/r))]. To appropriately selected Q, we are now in the position

to uses the ordered weighted averaging (OWA) method Manetsch and Park (1977), for aggregating the expert opinions. Assume that we have r expert, each of which has a unit evaluation for the *i*th project denoted P_{ik}. The first step in OWA procedure is to order the P_{ik}S in descending order: thus we shall B_j as the *j*th highest score among the expert's unit scores for the project. To find the overall evaluation for the *i*th project, P_i, we calculate $P_i = Max_{j=1,...,r}[Q(j) \Lambda Bj]$, which Bj can be seen as the worst of the decision maker feels that the support of at least j expert is. The term Q (j) Λ Bj can be seen as weighting of an object's j best scores, Bj, and the decision maker's requirement that j people support the project, Q(j). The max operation plays a role akin to the summation in usual numeric averaging procedure.

Quality Function Deployment

Quality Function Deployment (QFD) is a method for structured product planning and development that enables a development team to specify clearly customer's needs, and then to evaluate each proposed product capability systematically in term of its impact on meeting those need. The QFD process involves constructing one or more matrices (sometimes called "House of Quality" (HOQ). It displays the customer's needs (the "Voice of the Customer") along the left, and the development team's technical response to meeting those needs along the top (Cohen, 1995). The matrix consists of several section or sub matrices joined together in various ways, each containing information related to the other.

The original intent of QFD was to provide product developers with a systematic method for "deploying" the Voice of Customer in to product design. Other benefits of QFD according to Dale (1995) are (1) increasing quality level and customer satisfaction, (2) increasing company's performance, (3) cycle time reduction, (4) increasing technical and staff's productivities, (5) complain quarantine's reduction, (6) increasing market opportunity, (7) increasing company's profitability, and (8) developing decision making process.

III. Research Methodology

Modeling was done in two steps. It was started with needs analysis, and followed by modeling of the system. Customer needs was key performance indicator that must be improved after the measurement process using Balanced Scorecard technique and based on management strategic system (Dale, 1995). In conjunction with needs to identify technical response, OWA Operators technique was used to investigate the relationship between each element of

technical response and each customer need. Expert survey method was done to acquire the expert knowledge on key performance indicator in MSE's performance measurement and improvement process.

System modeling uses strategic management system based on resources and knowledge strategy. Strategic management was used to transform the data into knowledge related to performance improvement process. Snack MSE' performance improvement model designed by system approach which was consisted of 3 sub models. First step of improvement process was customer needs and technical response identification. The second step was to determine the importance of customer needs and its relationship with technical response. The last step was to determine performance improvement priority and give the recommendation. The configuration of model can be seen at Figure 1.

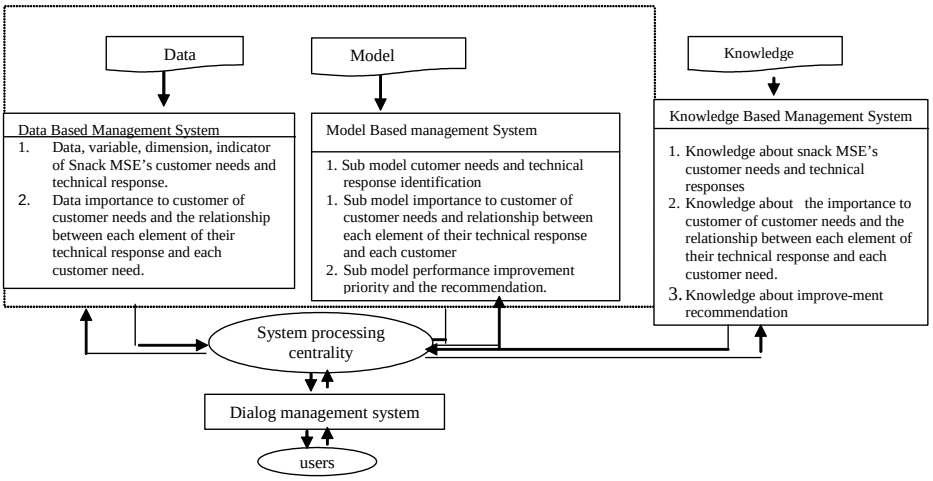

Figure 1. The Configuration of Snack MSE' Performance Improvement Model

Sub Model Customer Needs and Technical Response Identification

In this research, customer need was identified on preliminary research. Customer needs are key performance indicators that must be improved after the measurement process using Balanced Scorecard technique and based on management strategic approach (Dale, 1995). To identify technical response, relationship between each element of technical response and customer need was identified using OWA Operators technique.

Sub Model Correlation, Relationship, and Importance

Correlation that is referred to as the "roof" of House Of Quality (HOQ) sometimes called the technical correlation section. Identifying strength of correlation among technical characteristics was done by conducting depth interview with experts and then analyzed using OWA Operators. Once the technical correlation matrix has been rotated, the redundant row and columns removed, and correlation filled in by assign 2 = strong positive impact, 1= moderate positive impact, <blank>= no impact, -1= moderate negative impact, and -2 = strong negative impact.

The relationship section provides mapping between customer needs on one hand, and technical responses on another. Output of experts interview conducted by using OWA Operators technique, and relationship between customer needs and technical responses will be resulted by deploying correlation tool. Certain symbols are customarily used in QFD to denote these four possible impacts. If it is strongly linked, numerical value is 9, and the symbol ; if it is moderately linked, numerical value is 3, and the symbol O; if it is possibly linked, numerical value is 1, and the symbol ‡; if it is not linked, numerical value s 0, and the symbol <blank>.

The absolute importance entries are chosen from a scaled selection of importance, based on a five-point scale where the values 1 to 5 may be defined as 1 is not at all importance to the customer; 2 of minor importance to the customer; 3 of moderate importance to the customer; 4 very important to the customer; and 5 of highest importance to the customer. The aggregation importance values resulted by using *OWA* Operators technique.

Sub Model Performance Improvement Priority and Recommendation

Performance improvement process was done using QFD technique. From this step, priority improvement level was defined. The priority level was quantitative data in nature and represents the level of relationship between value of technical responses and customer needs to the importance to customer weighted. Technical responses priorities value (S) sometimes called importance of the HOWs.

Recommendation was resulted by elaborating the technical correlation result, theoretical study, and expert judgment intensively in depth interview consultation.

IV. Result and Discussion

Customer Needs and Technical Response Identification

Customer needs are key performance, which were identified on preliminary research (Dale, 1995). Performance measurement was done using Balanced Scorecard technique and based on management strategic approach. Previous research resulted 17 key performance indicators that must be improved, which are capacity, substitution price level, price level, transferability, replicability, customer growth/year, cost reduction/year, revenue growth/year, sales growth/ year, cost per unit, company profit level, customer retention level, customer satisfaction level, new product/year, employee capability level, and employee motivation level. This must be taken to be priority by management since finance in various different forms (Keegan et al., 1989; Jones et al., 1993; Meyer 1994; Ghalayani et al., 1997), customer satisfaction and human resources (Eccles, 1991; Kaplan and Norton, 1992) are considered to be critical dimensions of performance.

Identification of technical response using OWA Operators technique result 10 indicators of technical responses (Table 1). Indicators are measurement to four (4) variables, namely operating performance, resources managerial performance, environmental relationship performance, and policy responsibility. This result is in line with Kaplan (1983), Schmenner and Vollmann (1994), Neely et al. (1995), White (1996), and Medori and Steeple (2000).

Table 1 . Technical Responses of Snack MSE

Variable	Dimension	Indicator
Operating Performance	Sales and Market Position	1. Level of target customer sales (TS)
	Innovation	2. Level of new products development (NPD)
		3. Level of new product marketing (NPM)
	Quality and Productivity	4. Level of error and waste (E&W)
		5. Level of output per capital comparatively (OC)
	Profitability	6. Level of ability to make money (AMM)
Resources Managerial Performance	Organization Development and Motivation	7. Level of employer motivation (EM)
	Capital Resources	8. Level of capital growth (CG)
Environmental Relationship Performance	Public and Environmental Responsibility	9. Level of customer responsibility (CR)
Policy Responsibility	Policy Installment	10. Level of quality standard installment (QSI)

Determination of customer needs weight and relationship value of weight level with technical characteristics was done using OWA Operators technique. The result can be seen at Table 2. As shown at that table, capacity indicator of key performance has strong relationship with target customer sales, output per capital comparatively, ability to make money, and capital growth levels of technical characteristics. As well, price level is strongly linked with, target customer sales, error and waste, output per capital comparatively, ability to make money, customer responsibility, and quality standard installment levels. Almost all key performances are strongly linked with technical performances, except substitution price level. It is linked with all technical characteristics weakly. Even though, substitution price level has only possibly linked with target customer sales level and employer motivation level, and there's no link with other technical characteristics. Employee capacity level of key performance link with all technical characteristics, with 7 out of 10 technical characteristics are strongly linked, one is possibly link and 2 are moderately linked.

Table 2. Relationship among Customer Needs and Technical Responses, and the Absolute Importance Value

Technical Responses		TS	NPD	NPM	E&	OC	AM M	EM	CG	CR	QSI	Importance to Customer
Key performance indicator		OP						RM		ER	Po	
External Environment Perspective	CL	9				9	9		9			4
	SPL	9	3	3	9	9	9	3	3	9	9	5
	PL	1						1				5
	TL	9		1	1	9	9	1	3	1	1	4
IEP	RL	3	9	9	3	1	1			1	3	4
	CGL	9	9		1	1	1			1	3	4
SPP	CRL	9	9	1		1	3	9	3	1	1	5
	RGL		1	1	9	9	3	3	3	1	1	4
	SGL	3	9	1	3	3	9	3	9	1	1	5
FP	CL	9	9	1	1	1	9	3	3	1	1	5
	CPU	1		1	9	9	3	1	1	1	1	4
	CPL	3	9	1	9	9	9	3	9	1	1	5
CP	CRL	9	3	3	1	0	3	1	1	9	9	4
	CSL	3	9	3	3	1	3	9	1	9	9	4
IPB	NPL	9	9	3			9	3	9	3	3	4
LG	ECL	9	9	9	9	9	3	3	1	3	3	4
P	EM L	3	9	3	9	9	3	9		3	3	4

Note : IEP = Internal Environment Perspective, SPP = Strategic Planning Perspective, FP = Financial Perspective, CP = Customer Perspective, IPB =Internal-Process-Business Perspective, LG = Learning and Growth, P = Perspective. OP = Operation Performance, RM = Resources Managerial, ER = Environmental Relationship, Po = Policy.

It is resulted that the most important to customer of key performance indicators are SPL, PL, CRL, SGL, CL, and CPL. Others key performance indicators are identified very important to customer.

The correlation that is referred to as the "roof" was resulted from interview to the experts. OWA Operators technique resulted correlation value among technical responses. According to result of HOQ, the priority level can be determined. There are 10 indicators relationship which show strong positive impact, for instance, between target customer sales and new product development, new product development and new product marketing, between output per capital with target customer sales, between output per capital with error and waste, between ability to make money with output per capital, ability to make money with error and waste, employer motivation with ability to make money, capital growth with employer motivation, capital growth with target customer sales, and between quality standard installment with customer responsibility. Moderate positive impact is shown by 4 relationship, for instances target customer sales with new product marketing, target customer sales with ability to make money, target customer sales with employer motivation, and target customer sales with customer responsibility; no one relationship shows negative impact. The others relationship show no impact.

Verification and Validation Model

Modeling was done using system approach, so qualitative assessments such as subject matter expert and peer review were used. Formal process by face validation was chosen ((Illgen, 2002; Pace, 2003). As shown by verification process, model logic was appropriate with the existing condition. In validation process, the model can interpret performance improvement process of MSE banana crispy chip generally.

Model Implementation

Model implementation was done on MSE banana crispy chip in Bandar Lampung, Lampung Province, Indonesia. The result shows the improvement priorities. The improvement recommendation was tended to new product creation, by increasing the ability to transfer and replicate, increasing employee capability, motivation, and empowerment.

Improvement recommendation for each technical response can be seen at Table 3. Most indicators need to be improved are grouped in operating performance variable. To list a few among them, improving level of target customer sales can be done by increasing production capacity, new product

development, new product amount, employee capability, optimize output per material, decreasing product price level, and increasing new customer.

Table 3. Improvement Recommendation for Each Technical Responses

Variable	Indicator	Recommendation
Operating Performance	Level of Target Customer Sales	- Increasing production capacity - Increasing new product development - Increasing new product amount - Increasing employee capability - Optimize output per material - Decreasing product price level - Increasing new customer
	New Product Development	- Increasing transferability - Increasing replicability - Increasing employee capability - Increasing employee motivation - Increasing employee empowerment
	New Product Marketing	- Decreasing product price level - Increasing transferability - Increasing new product amount - Increasing employee capability - Increasing employee empowerment - Increasing product attribute
	Error and Waste	- Optimize responsibility and authority - Increasing employee capability - Increasing employee motivation - Increasing employee empowerment
	Output per Capital	- Decreasing waste - Increasing employee capability - Increasing employee motivation - Increasing employee empowerment
	Ability to Make Money	- Increasing production capacity - Decreasing product price level - Increasing new product amount - Increasing employee empowerment - Increasing employer motivation
Resources Managerial Performance	Employer Motivation	- Increasing transferability - Increasing replicability - Increasing employee motivation - Increasing employee empowerment
	Capital Growth	- Increasing production capacity - Increasing new product quantity
Environmental Relationship Performance	Customer Responsibility	- Increasing product quality level - Increasing product attribute - Increasing quality standard installment level
Policy Responsi-bility	Quality Standard	- Increasing product quality level - Increasing customer retention - Increasing customer satisfaction level - Increasing product attribute - Increasing employee capability - Increasing employee empowerment

There are 5 activities which can be done to improve new product development, i.e. by increasing transferability, replicability, employee capability, employ motivation, and employ empowerment. Those activities are internally in nature to the SME.

On new marketing product, improvement can be done by decreasing product price level, increasing transferability, new product amount, employee capability, employee empowerment, and product attribute.

As well, error and waste can be improved by optimize responsibility and authority, increasing employee capability, employee motivation, and employee empowerment. Decreasing waste, increasing employee capability, employee motivation, and employee empowerment will lead to improvement of output per capital. It can be also stated that improvement of ability to make money can be done by increasing production capacity, decreasing product price level, increasing new product amount, employee empowerment, and employer motivation.

Further, increasing transferability, replicability, employee motivation, employee empowerment, production capacity, and new product quantity will lead to improvement of resources managerial performances variables. On environmental relationship performance, activities need to consider are increasing product quality level, product attribute, and quality standard installment level.

Finally, in improvement of policy responsibility, it needs to consider the increasing of product quality level, customer retention, customer satisfaction level, product attribute, employee capability, and employee empowerment.

V. Conclusion and Suggestion

Based on result, it's evident to conclude that customer needs are linked with technical characteristics strongly except for substitution price level. It is resulted that the most important to customer of key performance indicators are substitution price level, price level, customer retention level, sales growth level, capacity level, and company profit level. Others key performance indicators are identified very important to customer.

Banana crispy chips as economic activator in Lampung province needs to improve continuously. Such improvements can be done toward the increasing of production capacity, new product development, new product amount, employee capability, optimize output per material, decreasing product price level, and

increasing new customer. New product development can be performed by increasing transferability, replicability, employee capability, employ motivation, and employ empowerment. On new product amount, improvement can be done by decreasing product price level, increasing transferability, new product amount, employee capability, employee empowerment, and product attribute.

Output optimization will be resulted when error and waste can be improved. Decreasing waste, increasing employee capability, employee motivation, and employee empowerment will lead to improvement of output per capital. It can be also stated that improvement of ability to make money can be done by increasing production capacity, decreasing product price level, increasing new product amount, employee empowerment, and employer motivation. Further, increasing transferability, replicability, employee motivation, employee empowerment, production capacity, and new product quantity will lead to improvement of resources managerial performances variables. On environmental relationship performance, activities need to consider are increasing product quality level, product attribute, and quality standard installment level.

Finally, in improvement of policy responsibility, it needs to consider the increasing of product quality level, customer retention, customer satisfaction level, product attribute, employee capability, and employee empowerment.

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